

Part III—Building and Equipment Design Features

CHAPTER 5

FIRE SERVICE FEATURES

SECTION 501

GENERAL

501.1 Scope. Fire service features for buildings, structures and premises shall comply with this chapter.

501.2 Permits. A permit shall be required as set forth in Sections 105.6 and 105.7.

501.3 Construction documents. *Construction documents* for proposed fire apparatus access, location of *fire lanes*, security gates across fire apparatus access and *construction documents* and hydraulic calculations for fire hydrant systems shall be submitted to the fire department for review and approval prior to construction.

501.4 Timing of installation. When fire apparatus access roads or a water supply for fire protection is required to be installed, such protection shall be installed and made serviceable prior to and during the time of construction except where approved alternative methods of protection are provided. Temporary street signs shall be installed at each street intersection when construction of new roadways allows passage by vehicles in accordance with Section 505.2.

SECTION 502

DEFINITIONS

502.1 Definitions. The following terms are defined in Chapter 2:

AGENCY.

FIRE APPARATUS ACCESS ROAD.

FIRE COMMAND CENTER.

FIRE DEPARTMENT MASTER KEY.

FIRE LANE.

KEY BOX.

TRAFFIC CALMING DEVICES.

SECTION 503

FIRE APPARATUS ACCESS ROADS

503.1 Where required. *Fire apparatus access roads* shall be provided and maintained in accordance with Sections 503.1.1 through 503.1.3 and Appendix D as amended.

503.1.1 Buildings and facilities. *Approved fire apparatus access roads* shall be provided for every facility, building or portion of a building hereafter constructed or moved into or within the jurisdiction. The fire apparatus access road shall comply with the requirements of this section and shall extend to within 150 feet (45 720 mm) of all portions of the facility and all portions of the exterior walls of the first story of the building as measured by an *approved* route around the exterior of the building or facility.

Exception: The *fire code official* is authorized to increase the dimension ~~((of 150 feet (45 720 mm)))~~ where any of the following conditions occur:

1.1 The building is equipped throughout with an *approved automatic sprinkler system* installed in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3~~((-))~~, the dimension may be increased to 375 feet (114300 mm).

1.2 Fire apparatus access roads cannot be installed because of location on property, topography, waterways, nonnegotiable grades or other similar conditions, and an *approved* alternative means of fire protection is provided.

1.3 There are not more than two Group R-3 or Group U occupancies ~~((-))~~, the dimension may be increased to 200 feet (60960 mm).

2. Where approved by the *fire code official*, fire apparatus access roads shall be permitted to be exempted or modified for solar photovoltaic power generation facilities.

503.1.2 Additional access. The *fire code official* is authorized to require more than one fire apparatus access road based on the potential for impairment of a single road by vehicle congestion, condition of terrain, climatic conditions or other factors that could limit access.

503.1.3 High-piled storage. Fire department vehicle access to buildings used for *high-piled combustible storage* shall comply with the applicable provisions of Chapter 32.

503.2 Specifications. *Fire apparatus access roads* shall be installed and arranged in accordance with Sections 503.2.1 through 503.2.8.

503.2.1 Dimensions. *Fire apparatus access roads* shall have an unobstructed width of not less than 20 feet (6096 mm), exclusive of shoulders, except for *approved* security gates in accordance with Section 503.6, and an unobstructed vertical clearance of not less than 14 feet (4267 mm) ~~((13 feet 6 inches (4115 mm).))~~

Exceptions:

1. Access roads serving not more than two Group R-3 or U occupancies shall have an unobstructed width of not less than 12 ft.

2. Public streets shall be in accordance with the Seattle Right of Way Improvements Manual.

503.2.2 Authority. The *fire code official* shall have the authority to require or permit modifications to the required access widths where they are inadequate for fire or rescue operations or where necessary to meet the public safety objectives of the jurisdiction.

503.2.3 Surface. *Fire apparatus access roads* shall be designed and maintained to support the imposed loads of fire apparatus and shall be surfaced so as to provide all- weather driving capabilities.

503.2.4 Turning radius. The required turning radius of a *fire apparatus access road* shall be 25 feet minimum inside curb and 50 feet minimum outside curb. ~~((determined by the fire code official)).~~

503.2.5 Dead ends. Dead-end *fire apparatus access roads* in excess of 150 feet (45 720 mm) in length shall be provided with a turnaround in accordance with Appendix D as amended. ~~((an approved area for turning around fire apparatus.))~~

503.2.6 Bridges and elevated surfaces. Where a bridge or an elevated surface is part of a *fire apparatus access road*, the bridge shall be constructed and maintained in accordance with Seattle Right of Way Improvements Manual. ~~((AASHTO HB 17.))~~ Bridges and elevated surfaces shall be designed for a live load sufficient to carry the imposed loads of fire apparatus. Vehicle load limits shall be posted at both entrances to bridges when required by the *fire code official*. Where elevated surfaces designed for emergency vehicle use are adjacent to surfaces which are not designed for such use, *approved* barriers, *approved* signs or both shall be installed and maintained when required by the *fire code official*.

503.2.7 Grade. The grade of the *fire apparatus access road* shall be in accordance with Appendix D as amended. ~~((within the limits established by the fire code official based on the fire department's apparatus.))~~

503.2.8 Angles of approach and departure. The angles of approach and departure for *fire apparatus access roads* shall be in accordance with the Seattle Right of Way Improvements Manual. ~~((within the limits established by the fire code official based on the fire department's apparatus.))~~

503.3 Marking. Where required by the *fire code official*, *approved* signs or other *approved* notices or markings that include the words NO PARKING—FIRE LANE shall be provided for *fire apparatus access roads* to identify such roads or prohibit the obstruction thereof. The means by which *fire lanes* are designated shall be maintained in a clean and legible condition at all times and be replaced or repaired when necessary to provide adequate visibility.

503.4 Obstruction of fire apparatus access roads. *Fire apparatus access roads* shall not be obstructed in any manner, including the parking of vehicles. The minimum widths and clearances established in Section 503.2.1 and 503.2.2 shall be maintained at all times.

503.4.1. Traffic calming devices. Traffic calming devices shall be prohibited unless *approved* by the *fire code official*.

503.5 Required gates or barricades. The *fire code official* is authorized to require the installation and maintenance of gates or other *approved* barricades across *fire apparatus access roads*, trails or other accessways, not including public streets, alleys or highways. Electric gate operators, where provided, shall be *listed* in accordance with UL 325. Gates intended for automatic operation shall be designed, constructed and installed to comply with the requirements of ASTM F 2200.

503.5.1 Secured gates and barricades. When required, gates and barricades shall be secured in an *approved* manner. Roads, trails and other accessways that have been closed and obstructed in the manner prescribed by Section 503.5 shall not be trespassed on or used unless authorized by the owner and the *fire code official*.

Exception: The restriction on use shall not apply to public officers acting within the scope of duty

503.6 Security gates. The installation of security gates across a *fire apparatus access road* shall be *approved* by the *fire code official*. Where security gates are installed, they shall have an approved means of emergency operation. The security gates and the emergency operation shall be maintained operational at all times. Electric gate operators, where provided, shall be *listed* in accordance with UL 325. Gates intended for automatic operation shall be designed, constructed and installed to comply with the requirements of ASTM F 2200.

SECTION 504

ACCESS TO BUILDING OPENINGS AND ROOFS

504.1 Required access. Exterior doors and openings required by this code or the *International Building Code* shall be maintained readily accessible for emergency access by the fire department. An *approved* access walkway leading from fire apparatus access roads to exterior openings shall be provided where required by the *fire code official*.

504.2 Maintenance of exterior doors and openings. Exterior doors and their function shall not be eliminated without prior approval. Exterior doors that have been rendered non-functional and that retain a functional door exterior appearance shall have a sign affixed to the exterior side of the door with the words THIS DOOR BLOCKED. The sign shall consist of letters having a principal stroke of not less than $\frac{3}{4}$ inch (19.1 mm) wide and at least 6 inches (152 mm) high on a contrasting background. Required fire department access doors shall not be obstructed or eliminated. *Exit* and *exit access* doors shall comply with Chapter 10. Access doors for *high-piled combustible storage* shall comply with Section 3206.7.

504.3 Stairway access to roof. New buildings four or more stories above grade plane, except those with a roof slope greater than four units vertical in 12 units horizontal (33.3- percent slope), shall be provided with a *stairway* to the roof. *Stairway* access to the roof shall be in accordance with Section 1009.13. Such *stairway* shall be marked at street and floor levels with a sign indicating that the *stairway* continues to the roof. Where roofs are used for roof gardens or for other purposes, *stairways* shall be provided as required for such occupancy classification.

SECTION 505

PREMISES IDENTIFICATION

505.1 Address identification. New and existing buildings shall be provided with *approved* address identification. The address identification shall be legible and placed in a position that is visible from the street or road fronting the property. Address identification characters shall contrast with their background. Address numbers shall be Arabic numbers or alphabetical letters. Numbers shall not be spelled out. Each character shall be not less than 4 inches (102 mm) high with a minimum stroke width of $\frac{1}{2}$ inch (12.7 mm). Where required by the *fire code official*, address identification shall be provided in additional *approved* locations to facilitate emergency response. Where access is by means of a private road and the building cannot be viewed from the *public way*, a monument, pole or other sign or means shall be used to identify the structure. Address identification shall be maintained.

505.2 Street or road signs. Streets and roads shall be identified with *approved* signs. Temporary signs shall be installed at each street intersection when construction of new roadways allows passage by vehicles. Signs shall be of an *approved* size, weather resistant and be maintained until replaced by permanent signs.

SECTION 506

KEY BOXES

506.1 Point of Information

The fire code official has approved the “Knox Box” as the access key box for use in the City of Seattle. For more information see Seattle Fire Department Information Client Assistance Memo 5965 Key Boxes for Emergency Access.

506.1 Where required. Key boxes shall be installed as follows:

506.1.1 ((Locks)) Access key box. Where access to or within a structure or an area is restricted because of secured openings or where immediate access is necessary for life-saving or fire-fighting purposes, the *fire code official* is authorized to require a key box to be installed in an *approved* location. The key box shall be of an *approved* type *listed* in accordance with UL 1037, and shall contain keys to gain necessary access as required by the *fire code official*.

506.1.2 Elevator key box. An elevator key box locked and keyed to the standard city elevator key box access key shall be provided at the designated recall floor above the Phase I recall switch or in the main lobby above the hall call button when no recall feature exists.

506.1.2.1 Elevator key box requirements. The elevator key box shall meet the following standards:

1. Dimensions – 8 inches (203 mm) high, 6 inches (152 mm) wide and 1 inches (25 mm) deep.
2. Material – 16 gauge steel welded.
3. Color – red unless located in the main lobby above the call button, six feet nominal above the floor, in which case any color is approved.
4. Labeling – “FOR FIRE DEPARTMENT USE.”
5. Lock openable with factory restricted Medeco 3, level 7 key
6. Mounting height shall be 6 feet (1829 mm) nominal above the floor.

506.1.2.2 Elevator key box contents. Keys for access to and for the operation of elevator equipment shall be tagged, labeled and retained in the key box. The elevator key box shall contain standard and nonstandard fire emergency service keys (Phase I and II, one key for each switch) in addition to keys for all of the following:

1. Machine room door;
2. Secondary level door;
3. Pit door;
4. Roof door;
5. Independent, hospital emergency and/or attendant operation;
6. Hoistway access;
7. Mechanical hoist access devices (broken arm, lunar, etc.);
8. Miscellaneous switch keys;
9. Fire alarm panel room;
10. Sprinkler valve control room

506.1.2.2 Point of Information

Due to security consideration, elevator key boxes should not contain master keys to tenant spaces. Keys in elevator key boxes should be limited to those for access of the building systems and equipment listed in *Seattle Fire Code*, Section 506.1.2.2.

506.1.((4))3 Locks. An *approved* lock shall be installed on gates or similar barriers when required by the *fire code official*.

~~((506.1.2 Key boxes for nonstandardized fire service elevator keys. Key boxes provided for nonstandardized fire service elevator keys shall comply with Section 506.1 and all of the following:~~

- ~~1. The key box shall be compatible with an existing rapid entry key box system in use in the jurisdiction and approved by the fire code official.~~
- ~~2. The front cover shall be permanently labeled with the words "Fire Department Use Only — Elevator Keys."~~
- ~~3. The key box shall be mounted at each elevator bank at the lobby nearest to the lowest level of fire department access.~~
- ~~4. The key box shall be mounted 5 feet 6 inches (1676 mm) above the finished floor to the right side of the elevator bank.~~
- ~~5. Contents of the key box are limited to fire service elevator keys. Additional elevator access tools, keys and information pertinent to emergency planning or elevator access shall be permitted when authorized by the fire code official.~~
- ~~6. In buildings with two or more elevator banks, a single key box shall be permitted to be used when such elevator banks are separated by not more than 30 feet (9144 mm). Additional key boxes shall be provided for each individual elevator or elevator bank separated by more than 30 feet (9144 mm).~~

~~**Exception:** A single key box shall be permitted to be located adjacent to a *fire command center* or the non-standard fire service elevator key shall be permitted to be secured in a key box used for other purposes and located in accordance with Section 506.1.))~~

506.2 Key box maintenance. The operator of the building shall immediately notify the *fire code official* and provide the new key when a lock is changed or rekeyed. The key to such lock shall be secured in the key box.

SECTION 507

FIRE PROTECTION WATER SUPPLIES

507.1 Required water supply. An *approved* water supply capable of supplying the required fire flow for fire protection shall be provided to premises upon which facilities, buildings or portions of buildings are hereafter constructed or moved into or within the jurisdiction, and for buildings undergoing a substantial alteration as determined by the Seattle Department of Construction and Inspections.

507.2 Type of water supply. A water supply shall consist of reservoirs, pressure tanks, elevated tanks, water mains or other fixed systems capable of providing the required fire flow.

507.2.1 Private fire service mains. Private fire service mains and appurtenances shall be installed in accordance with NFPA 24.

507.2.2 Water tanks. Water tanks for private fire protection shall be installed in accordance with NFPA 22.

507.3 Fire flow. Fire-flow requirements for buildings or portions of buildings and facilities shall be in accordance with Appendix B. ~~((determined by an approved method-))~~

Exceptions:

1. Fire flow requirements for shipyards and designated marine hot work facilities shall be in accordance with Administrative Rule 26.02.14 and any future revisions to this rule adopted by the fire code official.
2. Fire flow requirements for new and existing covered marinas shall be in accordance with Chapters 36 and 94 respectively.
3. [W] Fire flow is not required for structures under 500 square feet with a B, U, or I occupancy where structures are at least 30 feet from any other structure and are used only for recreation.

507.4 Water supply test. The *fire code official* shall be notified prior to the water supply test. Water supply tests shall be witnessed by the *fire code official* or approved documentation of the test shall be provided to the *fire code official* prior to final approval of the water supply system.

507.5 Fire hydrant systems. Fire hydrant systems shall comply with Sections 507.5.1 through 507.5.6.

507.5.1 Where required. Where a portion of the facility or building hereafter constructed or moved into or within the jurisdiction is more than 400 feet (122 m) from a hydrant on a fire apparatus access road, as measured by an *approved* route around the exterior of the facility or building, on-site fire hydrants and mains shall be provided where required by the *fire code official*.

Exceptions:

1. For Group R-3 and Group U occupancies, the distance requirement shall be 600 feet (183 m).
2. For buildings equipped throughout with an *approved automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2, the distance requirement shall be 600 feet (183 m).

507.5.1.1 Hydrant for standpipe systems. Buildings equipped with a standpipe system installed in accordance with Section 905 shall have a fire hydrant within 100 feet (30480mm) of the fire department connections.

Exception: The distance shall be permitted to exceed 100 feet (30480mm) where approved by the *fire code official*.

507.5.2 Inspection, testing and maintenance. Fire hydrant systems shall be subject to periodic tests as required by the *fire code official*. Fire hydrant systems shall be maintained in an operative condition at all times and shall be repaired where defective. Additions, repairs, *alterations* and servicing shall comply with *approved* standards. Records of tests and required maintenance shall be maintained.

507.5.3 Private fire service mains and water tanks. Private fire service mains and water tanks shall be periodically inspected, tested and maintained in accordance with NFPA 25 at the following intervals:

1. Private fire hydrants (all types): Inspection annually and after each operation; flow test and maintenance annually.
2. Fire service main piping: Inspection of exposed, annually; flow test every 5 years.
3. Fire service main piping strainers: Inspection and maintenance after each use.

Records of inspections, testing, and maintenance shall be maintained.

507.5.4 Obstruction. Unobstructed access to fire hydrants shall be maintained at all times. The fire department shall not be deterred or hindered from gaining immediate access to fire protection equipment or fire hydrants.

507.5.5 Clear space around hydrants. A 3-foot (914 mm) clear space shall be maintained around the circumference of fire hydrants, except as otherwise required or *approved*.

507.5.6 Physical protection. Where fire hydrants are subject to impact by a motor vehicle, guard posts or other *approved* means shall comply with Section 312. Any horizontal, lateral or diagonal elements that are a part of the protection for a fire hydrant shall not interfere with the ability to freely access and safely operate the hydrant.

SECTION 508

FIRE COMMAND CENTER

508.1 General. Where required by other sections of this code and in all buildings classified as high-rise buildings by the *International Building Code*, a *fire command center* for fire department operations shall be provided and shall comply with Sections 508.1.1 through 508.1.6.

508.1.1 Location and access. The location and accessibility of the *fire command center* shall be *approved* by the *fire code official*.

[W]508.1.2 Separation. The *fire command center* shall be separated from the remainder of the building by not less than a ~~((1))~~2-hour *fire barrier* constructed in accordance with Section 707 of the *International Building Code* or *horizontal assembly* constructed in accordance with Section 711 of the *International Building Code*, or both.

508.1.3 Size. The *fire command center* shall not be less than ~~((0.015 percent of the total building area of the facility served or))~~200 square feet (19 m²) in area~~((, whichever is greater,))~~ with a minimum dimension of ~~((0.7 times the square root of the room area or))~~ 10 feet (3048 mm)~~((, whichever is greater))~~.

508.1.4 Layout approval. A layout of the *fire command center* and all features required by this section to be contained therein shall be submitted for approval prior to installation.

508.1.5 Storage. Storage unrelated to operation of the *fire command center* shall be prohibited.

508.1.6 Required features. The *fire command center* shall comply with NFPA 72 and shall contain the following features:

1. The emergency voice/alarm communication system control unit.
2. The fire department communications system.
3. Fire detection and alarm system annunciator.
4. Annunciator unit visually indicating the location of the elevators and whether they are operational.

5. Status indicators and controls for air distribution systems.
6. The fire-fighter's control panel required by Section 909.16 for smoke control systems installed in the building.
7. Controls for unlocking *interior exit stairway* doors simultaneously.
8. Sprinkler valve and water-flow detector display panels.
9. Emergency and standby power status indicators.
10. A telephone for fire department use with controlled access to the public telephone system.
11. Fire pump status indicators.
12. Schematic building plans indicating the typical floor plan and detailing the building core, *means of egress, fire protection systems*, fire-fighting equipment and fire department access, and the location of *fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions*.
13. An *approved* Building Information Card that contains, but is not limited to, the following information:
 - 13.1 General building information that includes: property name, address, the number of floors in the building (above and below grade), use and occupancy classification (for mixed uses, identify the different types of occupancies on each floor), estimated building population (i.e., day, night, weekend);
 - 13.2 Building emergency contact information that includes: a list of the building's emergency contacts (e.g., building manager, building engineer, etc.) and their respective work phone number, cell phone number, and e-mail address;
 - 13.3 Building construction information that includes: the type of building construction (e.g., floors, walls, columns, and roof assembly);
 - 13.4 Exit stair information that includes: number of *exit stairs* in the building, each *exit stair* designation and floors served, location where each *exit stair* discharges, *exit stairs* that are pressurized, *exit stairs* provided with emergency lighting, each *exit stair* that allows reentry, *exit stairs* providing roof access; elevator information that includes: number of elevator banks, elevator bank designation, elevator car numbers and respective floors that they serve, location of elevator machine rooms, location of sky lobby, location of freight elevator banks;
 - 13.5 Building services and system information that includes: location of mechanical rooms, location of building management system, location and capacity of all fuel oil tanks, location of emergency generator, location of natural gas service;
 - 13.6 *Fire protection system* information that includes: locations of standpipes, location of fire pump room, location of fire department connections, floors protected by *automatic sprinklers* and location of different types of *automatic sprinkler systems* installed including but not limited to dry, wet and pre-action;
 - 13.7 Hazardous material information that includes: location and quantity of hazardous material.
14. Work table.
15. Generator supervision devices, manual start and stop (~~((transfer))~~) features.
16. Public address system, where specifically required by other sections of this code.
17. Elevator fire recall switch in accordance with ASME A17.1/CSA B44.
18. Elevator emergency or standby power selector switch(es), where emergency or legally required standby power is provided.
19. On-site fire protection water tank fill valve control switch, tank level indicators, tank low level alarm, and tank fill signal.

SECTION 509

FIRE PROTECTION AND UTILITY EQUIPMENT IDENTIFICATION AND ACCESS

509.1 Identification. Fire protection equipment shall be identified in an *approved* manner. Rooms containing controls for air-conditioning systems, sprinkler risers and valves, or other fire detection, suppression or control elements shall be identified for the use of the fire department. *Approved* signs required to identify fire protection equipment and equipment location shall be constructed of durable materials, permanently installed and readily visible.

509.1.1 Utility identification. Where required by the *fire code official*, gas shutoff valves, electric meters, service switches and other utility equipment shall be clearly and legibly marked to identify the unit or space that it serves. Identification shall be made in an *approved* manner, readily visible and shall be maintained.

509.2 Equipment access. *Approved* access shall be provided and maintained for all fire protection equipment to permit immediate safe operation and maintenance of such equipment. Storage, trash and other materials or objects shall not be placed or kept in such a manner that would prevent such equipment from being readily accessible.

SECTION 510

EMERGENCY RESPONDER RADIO COVERAGE

510.1 Emergency responder radio coverage in new buildings. ~~((New buildings shall have a))~~ *Approved* radio coverage for emergency responders shall be provided within ~~((the))~~ buildings meeting any of the following conditions:

1. High rise buildings;
2. The total building area is 50,000 square feet or more;
3. The total *basement* area is 10,000 square feet or more; or
4. There are floors used for human occupancy more than 30 feet below the finished floor of the lowest level of exit discharge.

The radio coverage system shall be installed in accordance with Sections 510.4 through 510.5.3 of this code and with the provisions of NFPA 72, National Fire Alarm and Signaling Code. ~~((based upon the existing coverage levels of the public safety communication systems utilized by the jurisdiction, measured at the exterior of the building.))~~ This section shall not require improvement of the existing public safety communication systems.

Exceptions:

- ~~((Where approved by the building official and the fire code official, a wired communication system in accordance with Section 907.2.12.2 shall be permitted to be installed or maintained instead of an approved radio coverage system.))~~
- ~~((Where it is determined by the fire code official that the radio coverage system is not needed.))~~ Buildings and areas of buildings that have minimum radio coverage signal strength levels of the King County Regional 800 MHz Radio System within the building in accordance with Section 510.4.1 without the use of a radio coverage system.
- In facilities where emergency responder radio coverage is required and such systems, components or equipment required could have a negative impact on the normal operations of that facility, the *fire code*

official shall have the authority to accept an automatically activated emergency responder radio coverage system.

4. One and two family dwellings and townhouses.

510.2 Emergency responder radio coverage in existing buildings. Existing buildings shall be provided with *approved* radio coverage for emergency responders as required in Chapter 11.

510.3 Permit required. A construction permit for the installation of or modification emergency responder radio coverage systems and related equipment is required as specified in Section 105.7.6. Maintenance performed in accordance with this code is not considered a modification and does not require a permit.

510.4 Technical requirements. Systems, components, and equipment required to provide emergency responder radio coverage systems shall comply with Sections 511.4.1 through 511.4.2.8.

510.4.1 Emergency responder communication enhancement system signal strength. The building shall be considered to have acceptable emergency responder communication system coverage when signal strength measurements in ~~((95))90~~ percent of all areas on each floor of the building meet the signal strength requirements in Sections 510.4.1.1 through 510.4.1.3.

510.4.1.1 Minimum signal strength into the building. The minimum inbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the *fire code official*. The inbound signal level shall be sufficient to provide not less than a Delivered Audio Quality (DAQ) of 3.0 or an equivalent Signal-to-Interference-Plus-Noise Ratio (SINR) applicable to the technology for either analog or digital signals. A minimum signal strength of -95 dBm shall be receivable within the building when transmitted from the King County Regional 800 MHz Radio System.

510.4.1.2 Minimum signal strength out of the building. The minimum outbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the *fire code official*. The inbound signal level shall be sufficient to provide not less than a Delivered Audio Quality (DAQ) of 3.0 or an equivalent SINR applicable to the technology for either analog or digital signals. A minimum signal strength of -95 dBm shall be received by the King County Regional 800 MHz Radio System when transmitted from within the building.

Exception: Critical areas, such as the fire command center(s), the fire pump room(s), interior exit stairways, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas required by the *fire code official*, shall be provided with 99 percent floor area radio coverage.

510.4.1.3 System performance. Signal strength shall be sufficient to meet the requirements of the applications being utilized by public safety for emergency operations through the coverage area as specified by the *fire code official* in Section 510.4.2.2.

510.4.2 System design. The emergency responder radio coverage system shall be designed in accordance with Sections 510.4.2.1 through 510.4.2.8 and NFPA 1221.

510.4.2.1 Amplification systems and components. Buildings and structures that cannot support the required level of radio coverage shall be equipped with systems and components to enhance the public safety radio signals and achieve the required level of radio coverage specified in Sections 510.4.1 through 510.4.1.3. Public safety communications enhancement systems utilizing radio frequency-emitting devices and cabling shall be ~~((approved))~~ allowed by the ((fire code official)) City of Seattle's Radio System Manager. Prior to installation, all RF-emitting devices shall have the certification of the ~~((radio licensing authority))~~ City of Seattle's Radio System Manager and be suitable for public safety use.

510.4.2.2 Technical criteria. The ~~((fire code official))~~ City of Seattle's Radio System Manager shall ~~((maintain a document providing the specific technical information and requirements for the emergency responder communications coverage system. This document shall contain, but not be limited to,))~~ provide the various frequencies required, the location of radio sites, the effective radiated power of radio sites, the maximum propagation delay in microseconds, the applications being used and other supporting technical information necessary for system design upon request by the building owner or owner's representative.

510.4.2.3 ((Standby)) Power supply sources. ~~((Emergency responder radio coverage systems shall be provided with dedicated standby batteries or provided with 2 hour standby batteries and connected to the facility generator power system in accordance with Section 1203. The standby power supply shall be capable of operating the emergency responder radio coverage system at 100 percent system capacity for a duration of not less than least 12 hours.))~~ Emergency responder radio coverage systems shall be provided with at least two independent and reliable power supply sources conforming to NFPA 72 and the Seattle Electrical Code, one primary and one secondary.

510.4.2.4 Signal booster requirements. If used, signal boosters shall meet the following requirements:

1. All signal booster components shall be contained in a National Electrical Manufacturer's Association (NEMA) 4-type waterproof cabinet or other approved enclosure.
2. Battery systems used for the emergency power source shall be contained in a NEMA 3R or higher-rated cabinet.
Exception: Listed battery systems that are contained in integrated battery cabinets.
3. Equipment shall have FCC or other radio licensing authority certification and be suitable for public safety use prior to installation.
4. Where a donor antenna exists, isolation shall be maintained between the donor antenna and all inside antennas to not less than 20dB greater than the system gain under all operating conditions.
5. Bi-Directional Amplifiers (BDAs) used in emergency responder radio coverage systems shall have oscillation prevention circuitry.
6. The installation of amplification systems or systems that operate on or provide the means to cause interference on any emergency responder radio coverage networks shall be coordinated and approved by the ~~((fire code official))~~ City of Seattle's Radio System Manager.
7. Unless otherwise approved by the City of Seattle's Radio System Manager, only channelized signal boosters shall be permitted.

510.4.2.5 System monitoring. The emergency responder radio enhancement system shall be monitored by a listed *fire alarm control unit*, or where approved by the *fire code official*, shall sound an audible signal at a constantly attended on-site location. Automatic supervisory signals shall include the following:

1. Loss of normal AC power supply.
2. System battery charger(s) failure.
3. Malfunction of the donor antenna(s).
4. Failure of active RF-emitting device(s).

5. Low-battery capacity at 70-percent reduction of operating capacity.
6. Failure of critical system components.
7. The communications link between the *fire alarm system* and the emergency responder radio enhancement system.

510.4.2.6 Additional frequencies and change of frequencies. The emergency responder radio coverage system shall be capable of modification or expansion in the event frequency changes are required by the FCC or other radio licensing authority, or additional frequencies are made available by the FCC or other radio licensing authority.

510.4.2.7 Design documents. The *fire code official* shall have the authority to require “as-built” design documents and specifications for emergency responder communications coverage systems. The documents shall be in a format acceptable to the *fire code official*.

510.4.2.8 Radio communication antenna density. Systems shall be engineered to minimize the near-far effect. Radio enhancement system designs shall include sufficient antenna density to address reduced gain conditions.

Exceptions:

1. Class A narrow band signal booster devices with independent AGC/ALC circuits per channel.
2. Systems where all portable devices within the same band use active power control features.

510.5 Installation requirements. The installation of the public safety radio coverage system shall be in accordance with NFPA 1221 and Sections 510.5.1 through 510.5.4.

510.5.1 Approval prior to installation. Amplification systems capable of operating on frequencies licensed to any public safety agency by the FCC or other radio licensing authority shall not be installed without prior coordination and approval of the ~~((fire code official))~~ City of Seattle’s Radio System Manager.

510.5.2 Minimum qualifications of personnel. The minimum qualifications of the system designer and lead ~~((installation))~~ acceptance test personnel shall include both of the following:

1. A valid FCC-issued general radio operators license.
2. Certification of in-building system training issued by an approved organization or approved school, or a certificate issued by the manufacturer of the equipment being installed.

~~((These qualifications shall not be required where demonstration of adequate skills and experience satisfactory to the fire code official is provided.))~~

510.5.3 Acceptance test procedure and system certification. When an emergency responder radio coverage system is required, and upon completion of installation, the building *owner* shall have the radio system tested to verify that two-way coverage on each floor of the building is in accordance with Section 510.4.1. ~~((not less than 95 percent))~~. The test procedure shall be conducted as follows

1. ~~((Each floor of the building shall be divided into a grid of 20 approximately equal test areas.))~~
Talk-back testing from a site to the King County Regional 800 MHz Radio System shall use Seattle Fire Department radio(s) and be witnessed by a representative of the Seattle Fire Department.

2. ~~((The test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency's radio communications system or equipment approved by the fire code official.))~~ Each floor of the building shall be divided into a grid of 20 approximately equal test areas.
3. ~~((Failure of more than one test area shall result in failure of the test.))~~ A test location approximately in the center of each test area shall be selected for the test, with the radio enabled to verify two-way communications to and from the outside of the building through the King County Regional 800 MHz Radio System. Once the test location has been selected, that location shall represent the entire test area. Failure in the selected test location shall be considered failure of that test area.
4. ~~((In the event that two of the test areas fail the test, in order to be more statistically accurate, the floor shall be permitted to be divided into 40 equal test areas. Failure of not more than two nonadjacent test areas shall not result in failure of the test. If the system fails the 40-area test, the system shall be altered to meet the 95 percent coverage requirement.))~~ The test for emergency responder radio coverage will be considered passed when 90% of the test locations on each floor are able to pass two-way communications to and from the outside of the building.
Exception: Critical areas shall be provided with 99 percent floor area radio coverage.
5. ~~((A test location approximately in the center of each test area shall be selected for the test, with the radio enabled to verify two-way communications to and from the outside of the building through the public agency's radio communications system. Once the test location has been selected, that location shall represent the entire test area. Failure in the selected test location shall be considered to be a failure of that test area. Additional test locations shall not be permitted.))~~
In the event that three of the test areas on a floor fail the talk back test, in order to be more statistically accurate, the floor shall be permitted to be divided into 40 equal test areas. If the system fails the 90% coverage requirement for the 40-area test, the emergency responder radio system shall be altered to meet the 90 percent coverage requirement.
Exception: Critical areas shall be provided with 99 percent floor area coverage.
6. The gain values/output levels of all amplifiers shall be measured and the test measurement results shall be kept on file with the building owner so that the measurements can be verified during annual tests. In the event that the measurement results become lost, the building owner shall be required to rerun the acceptance test to reestablish the gain values.
7. As part of the installation, a spectrum analyzer or other suitable test equipment shall be utilized to ensure spurious oscillations are not being generated by the subject signal booster. This test shall be conducted at time of installation and at subsequent annual inspections.
8. Systems incorporating Class B signal-booster devices or Class B broadband fiber remote devices shall be tested using two portable radios simultaneously conducting subjective voice quality checks. One portable radio shall position not greater than 10 feet (3048mm) from the indoor antenna. The second portable radio shall be positioned at a distance that represents the farthest distance from any indoor antenna. With both portable radios simultaneously keyed up on different frequencies within the same band, subjective audio testing shall be conducted and comply with DAQ levels as specified in Sections 510.4.1.1 and 510.4.1.2.
9. Prior to issuance of the building Certificate of Occupancy, the building owner or owner's representative shall provide the Seattle Fire Department with a certification letter stating that the emergency responder radio coverage system has been installed and tested in accordance with Sections 510.4 and 510.5, and that the system is complete and fully functional. A system acceptance test report shall be submitted to the City of Seattle's Radio System Manager, maintained on the premises and be made available to the fire department upon request. The report shall verify compliance with Section 510.5.4, and include the emergency responder radio coverage system equipment data sheets, diagram showing device locations and wiring schematic, and a copy of the electrical permit and system certification letter.

510.5.4 FCC compliance. The emergency responder radio coverage system installation and components shall also comply with all applicable federal regulations including, but not limited to, FCC 47 CFR Part 90.219.

510.6 Maintenance. The emergency responder radio coverage system shall be maintained operational at all times in accordance with Sections 510.6.1 through 510.6.5 (~~510.6.3.~~)

510.6.1 Testing and proof of compliance. The emergency responder radio coverage system shall be inspected and tested annually or whenever structural changes occur including additions or remodels that could materially change the original field performance tests. Testing shall consist of the following:

1. In-building coverage test as described in Section 510.5.4.
2. Signal boosters shall be tested to ensure that the gain/output level is the same as it was upon initial installation and acceptance.
3. Backup batteries and power supplies shall be tested under load of a period of one hour to verify that they will properly operate during an actual power outage. If within the 1-hour test period the battery exhibits symptoms of failure, the test shall be extended for additional 1-hour periods until the integrity of the battery can be determined.
4. All other active components shall be checked to verify operation within the manufacturer's specifications.
5. At the conclusion of the testing, a report, which shall verify compliance with Sections 510.5.4 and 510.6 shall be (~~submitted to the fire code official~~) maintained on the premises and be made available to the fire department upon request.

510.6.2 Additional frequencies. The building owner shall modify or expand the emergency responder radio coverage system at their expense in the event frequency changes are required by the FCC or additional frequencies are made available by the FCC. Prior approval of a public safety radio coverage system on previous frequencies does not exempt this section.

510.6.3 Field testing. (~~Agency~~) Seattle Fire Department personnel shall have the right to enter onto the property at any reasonable time to conduct field testing to verify the required level of radio coverage.

510.6.4 Qualifications of testing personnel. All tests shall be documented and signed by a person in possession of a current FCC General Radiotelephone Operator license, or a current technician certification issued by a nationally recognized organization, school or a certificate issued by the manufacturer of the equipment being installed.

510.6.5 Continuing operation/supervision. The occurrence of any fault in an emergency responder radio coverage system where the system function is decreased shall result in the transmission of a supervisory signal to a supervisory service. Systems that are out-of-service for more than 8 hours require notification to the fire code official.